

Intercropping patterns effect of cardamom and cayenne pepper on population and intensity of whitefly pest's attacks (*Bemisia tabaci*)

by Iqbal Erdiansyah

Submission date: 24-Aug-2022 09:14AM (UTC+0700)

Submission ID: 1886201940

File name: Intercroping_patern.pdf (385.15K)

Word count: 2795

Character count: 15377

PAPER · OPEN ACCESS

Intercropping patterns effect of cardamom and cayenne pepper on population and intensity of whitefly pest's attacks (*Bemisia tabaci*)

To cite this article: I Erdiansyah *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **980** 012010

View the [article online](#) for updates and enhancements.

You may also like

- [Assessment of maize-peanut intercropping and its potential waste usage for cattle feed in dry land](#)
I N Adijaya, N L G Budiari, I M R Yasa et al.
- [Intercropping Effects of Sophora davidii and Silage Maize on Soil Physicochemical Properties, Enzyme Activities and Yield](#)
Chao Zou, Leilei Ding, Yujun Zhang et al.
- [Intercropping of maize-mungbean to increase the farmer's income](#)
Syafuruddin and Suwardi



ECS The Electrochemical Society
Advancing solid state & electrochemical science & technology

242nd ECS Meeting

Oct 9 – 13, 2022 • Atlanta, GA, US

Early hotel & registration pricing ends September 12

Presenting more than 2,400 technical abstracts in 50 symposia

The meeting for industry & researchers in

BATTERIES
ENERGY TECHNOLOGY
SENSORS AND MORE!

 Register now!

 **ECS Plenary Lecture featuring M. Stanley Whittingham,**
Binghamton University
Nobel Laureate –
2019 Nobel Prize in Chemistry



Intercropping patterns effect of cardamom and cayenne pepper on population and intensity of whitefly pest's attacks (*Bemisia tabaci*)

I Erdiansyah^{1*}, E Eliyatningsih¹, V K Sari², D Nurahmanto³,
and A H Prayitno⁴

¹ Department of Agriculture Production, Politeknik Negeri Jember, Jl. Mastrip Po Box 164 Jember, Indonesia

² Faculty of Agriculture, Universitas Jember, Jl. Kalimantan No. 37, Sumbersari, Jember 68121, Indonesia

³ Faculty of Pharmacy, Universitas Jember, Jl. Kalimantan No. 2, Sumbersari, Jember 68121, Indonesia

⁴ Department of Animal Science, Politeknik Negeri Jember, Jl. Mastrip Po Box 164 Jember, Indonesia

* email: iqbal@polije.ac.id

Abstract. The study aimed to determine the population and intensity of attacks caused by whitefly pests on intercropping and monoculture cultivation areas. This research was conducted from June to August 2021 in Pace Village, Silo District, Jember Regency. The method used is to compare two intercropping and monoculture cultivation areas of medicinal plants cardamom - cayenne pepper. The first plot was cultivated in monoculture with pest control using an insecticide with the active ingredient Alfametrin 15 EC, while in the second plot, cayenne pepper - cardamom intercropped cultivation with a spacing of 1x2 meters and pest control without pesticides. A systematic random sampling of 50 plants in both cropping patterns on cultivated land. Observation of pest populations using insect nets, pitfall traps, and insect suction in the field. The data were analyzed using SPSS version 15.0. The data were tested for normality using Kosmogrofov Smirnov with non-parametric analysis. The results showed that the whitefly population in monoculture cayenne pepper cultivation had a higher average of 57.58 individuals, while in cayenne-cardamom intercropping cultivation, the population average was 51.00 and showed significantly different results. The intensity of whitefly attack showed significantly different results in monoculture cultivation of 45.58% while intercropping pattern of 50.10%.

1. Introduction

Maintenance of a cultivated plant by applying technical cultural control in the form of the use of an intercropping system that aims as a barrier in overcoming pests and diseases of cultivated plants, especially cayenne pepper. The production of cayenne pepper in Jember Regency 2019 based on Jember in Figures issued by the Central Statistics Agency [1] Jember reached 215,723 quintals when converted into kilograms, it was 21.5 million kilograms, but this amount was not sufficient for regional chili needs in Jember Regency. One of the problems in increasing the production of cayenne pepper, especially on a national scale, is the attack of pests and plant diseases.



Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

Published under licence by IOP Publishing Ltd

Pest attacks can reduce the growth and yield of cayenne pepper plants by up to 75% and even result in crop failure if not controlled properly [2]. So far, the number of insects that have been identified and proven to be associated with cayenne pepper plants has reached 200 species, which are divided into 154 types of pests, 59 species of predators, and 44 species of parasitoid insects. The pests that most often attack cayenne pepper plants are whitefly or *Bemisia tabaci*. Until now, the most frequently used business is chemical control, the use of chemical insecticides used to control whitefly pests such as Karbosulfan and others. Chemical pesticides have not succeeded in controlling whitefly pests in cayenne pepper cultivation and some chemical pesticides have not succeeded in controlling whitefly pests, causing these pests to become resistant [3]. Therefore, an integrated pest control method is needed to reduce or limit the use of chemical pesticides to reduce adverse effects.

The concept of integrated pest management is a control technique and tactic that utilizes plant cultivation using technical culture, namely intercropping cultivation of cultivated plants as an alternative step to control whitefly pests (*Bemisia tabaci*) compared to monoculture cultivation. Increased activity of useful insects such as predators and pest parasitoids around intercropping plants [4]. Intercropping between chili peppers and herbal plants can suppress pest populations on cultivated land and can increase crop yields. The combination of techniques or tactics of optimal soybean pest control technology components is determined based on knowledge of appropriate information about soybean pests, ecosystems, and socioeconomics based on the IPM approach [5]. This study was conducted to utilize the intercropping pattern of cayenne pepper and cardamom on cultivated land, and another objective was to determine how effective the intercropping pattern was in suppressing the population and intensity of attack on cultivated cayenne pepper.

2. Materials and Methods

The research was carried out in June – August 2021 at the Plant Protection Laboratory of the Jember State Polytechnic and in Pace Village, Silo District, Jember Regency, East Java Province. It is located at coordinates 11330 West Longitude – 114 East Longitude, 8LU-830LS. The research method used is non-parametric statistics based on the assumption of population distribution by comparing two chili cultivation areas that are intercropped with cardamom plants and chili pepper plants in monoculture.

2.1. Plant Cultivation Techniques

Land preparation is done by hoeing the soil to make it loose, then measuring the land as much as two beds, namely the first bed for intercropping treatment and the second bed for monoculture treatment, each stretch of land measuring 40 x 40 meters. Planting was done by planting two seeds per planting hole and one cardamom tuber next to chili plants with a size of 70 cm x 70 cm x 2 meters for intercropping treatment and cayenne pepper plants 70 cm x 70 cm in monoculture treatment.

2.2. Fertilizing and Laying Silver Mulch

Fertilization intercropping was carried out using NPK Mutiara. Fertilizer was applied twice at the age of 15 DAP and 35 DAP, while for cardamom plants it was done twice at the age of 25 DAP and 60 DAP using NPK Phonska fertilizer. Mulch is installed to protect plants from weeds and to maintain soil moisture after the beds are formed.

2.3. Observation of Whitefly Population

This is done by counting the number of whiteflies in the plant sample. Observations begin when the plants are two weeks old after planting, every two weeks until before harvest.

2.4. Observation of Whitefly Attack Intensity

The intensity of the whitefly attack was observed every two weeks when the plants were two weeks after planting. The calculation of the intensity of the whitefly pest attack is carried out by calculating the damage score of plant parts using the formula [6].

$$P = \frac{\sum(nv)}{Z \times N} \times 100\% \quad (1)$$

Information:

P = Intensity of attack/Damage

n = Number of samples observed for each category of damage

v = Score value for each category of damage

Z = The highest damage category score

N = Number of observed sample units

Observation of score values for plant leaf damage:

Score 0: No damage to plant leaves was observed

Score 1: There is less than 25% damage to the observed leaves

Score 2: There is damage between 25% - 50% on the observed leaves

Score 3: There is damage between 50% - 75% of the observed leaves

Score 4: There is more than 75% damage to the observed leaves

2.5. Insect Identification

Insects caught in insect nets and Yellow Pantrap were counted and identified in the plant protection laboratory of the Jember State Polytechnic.

2.6. Data Analysis

The data that has been obtained is processed statistically using the SPSS 15.0 application which includes a normality test using Kosmorogrof Smirnov, conducting a homogeneity test using One Way Anova and if there is a normal and homogeneous data distribution then it is continued with the Paired T-Test test, and if the distribution is not normal and not homogeneous or heterogeneous, then proceed with the Mann Whitney test.

3. Results and Discussion

3.1. Whitefly (*Bemisia tabaci*) Population

Observation of the whitefly population was carried out once a week for each sample of cayenne pepper on two lands with different planting systems.

Table 1. Whitefly Population

Treatments	Average (\pm SD)
Monoculture	57,58 \pm 5,04 ^a
Intercropping	51,00 \pm 4,15 ^b

Note: The data followed by different letters are significantly different according to the Mann Whitney test ($p < 0.05$)

According table 1. to Mann Whitney, the cultivation technique between monoculture and intercropping shows that the whitefly population is significantly different, according to [7], stated that the use of cardamom plants can be a barrier to whitefly pests and become a place for natural enemies to live so that whitefly populations can survive. controlled naturally and tends to be low compared to monoculture cultivated land.

The whitefly has a high reproductive potential and quickly develops resistance to insecticides. Yield loss due to whitefly attack due to loss of nutrient fluid, extensive soot dew on soybean pods and leaves not filled [8]. The development of the whitefly population is influenced by the host and the microclimate. Research revealed that the personality value of whitefly on weeds at 25°C and 29°C was higher than in

chili plants. The low population and intensity of whitefly attacks on soybeans are thought to be caused by local climatic conditions that do not support the development of whitefly pests. [9], stated that the factors that often trigger the development of pests are diversity in cultivation practices which include unequal planting time, seed quality, lack of water availability, soil fertility, and level of control [10].

3.2. Color Intensity of Whitefly Attack

The intensity of whitefly attack on the two treatments of intercropping system and monoculture of cayenne pepper showed significantly different results.

Table 2. Intensity of Whitefly Attack

Treatments	Average (\pm SD)
Monoculture	45,58 \pm 3,56 ^a
Intercropping	50,10 \pm 2,03 ^b

Note: The data followed by different letters are significantly different according to the Mann Whitney test ($p < 0.05$)

The table 2 above shows that the intensity of the whitefly attack was not significantly different between monoculture and intercropping land. This difference can be seen from the maintenance of plants when applying pesticides on cultivated land wherein monoculture treatment the application of the pesticide Alfamethrin is carried out where the nature of this pesticide is as an antifeedant, which gives an effect that can prevent insects from eating plants that are applied to pesticides so that the intensity of whitefly attacks can be controlled.

According to [11], The presence of natural enemies can suppress the presence of whitefly pests on cultivated land, especially ladybugs on intercropping land. Insects found in the intercropping area were whitefly, Trips tabaci, green ladybug, and pollinator butterfly. On cultivated land, natural predators of the whitefly were found, namely, the dome beetle (*Menochilus sexmaculatus*) which can prey on 200-400 whitefly nymphs, *M. sexmaculata* can prey on up to 51.5 whiteflies in 24 hours. In addition, the beetle *Delphastus* sp, sharp-eyed spider / *Oxyopes* was also found [12].

3.3. Cultivated Crop Yield

The weight of the sample of cayenne pepper on the two cultivated lands has a significant difference whereas cayenne pepper on monoculture land has a higher yield of 45.80 gr. while on intercropping land the yield is 1,424 g.

Table 3. Intensity of Whitefly Attack

Treatments	Average (\pm SD)
Monoculture	53,58 \pm 5,04 ^a
Intercropping	40,40 \pm 4,15 ^b

Note: The data followed by different letters are significantly different according to the Mann Whitney test ($p < 0.05$).

The difference in yield between the two cropping patterns of intercropping and monoculture is caused by the light intensity reception. Table 3 In monoculture chili land, it received more sunlight than intercropping which experienced many etiolated plants because cardamom plants were higher than cayenne pepper.

The second factor is the level of damage to cayenne pepper plants on intercropping cultivation land which has lower yields due to attacks by other pests such as fruit flies [13].

4. Conclusion

The conclusions in this study are the population of whitefly on monoculture cultivated land has a higher average of 57.58 tails individuals while on intercropping cultivation land has a population average of 51.00 tails individuals with significantly different results, the intensity of whitefly attack showed significantly different results with a value of 45.58% in the monoculture treatment and 50.10% in the intercropping treatment, and the yield showed a significantly different value between monoculture treatments, namely 53.58 g and intercropping 40.40 g.

3

Acknowledgment

We would like to thank the Head of The Research Center and Community Service who has funded this research through the State Polytechnic of Jember, Fiscal Year 2021.

References

- [1] Badan Pusat Statistik. 2020. Jember Dalam Angka. <https://jemberkab.bps.go.id/publication/2020/05/20/c43569a520090bef8f9b8919/kabupaten-jember-dalam-angka-2020.html>.
- [2] Marwoto dan A. Inayati. 2011. Kutu Kebul: Hama Kedelai yang Pengendaliannya Kurang Mendapat Perhatian. *Iptek Tanaman Pangan* 6(1): 87–98.
- [3] Inayati, A. dan Marwoto. 2012. Pengaruh Kombinasi Aplikasi Insektisida dan Varietas Unggul terhadap Intensitas Serangan Kutu Kebul dan Hasil Kedelai. *J. Penelitian Pertanian Tanaman Pangan* 31(1): 13–21.
- [4] Subagyo, V.N.O. dan P. Hidayat. 2014. Neraca kehidupan Kutukebul *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) Pada Tanaman Cabai dan Gulma Babadotan pada Suhu 25 °C dan 29 °C. *J. Entomologi Indonesia* 11(1): 11–18.
- [5] Agastya I M I, Julianto R P D dan Marwoto. 2020. Review : Pengaruh Pemanasan Global Terhadap Intensitas Serangan Kutu Kebul (*Bemisia Tabbaci* Genn) Dan Cara Pengendaliannya Pada Tanaman Kedelai. *Buana Sains* Vol 20 No 1 : 99-110. <http://repository.unitri.ac.id/1665/1/Jurnal%20Buana%20Sains%201.pdf>.
- [6] Digilib, its. 2003. Pengendalian Hama Tanaman. Available at :<http://digilib.its.ac.id/public/ITS-Undergraduate-10642-Chapter1.pdf>. Diakses 8 juni 2010.
- [7] Marwoto, S. Hardaningsih, dan A. Taufik 2008. Hama, penyakit dan masalah hara pada tanaman kedelai. Identifikasi dan Pengendaliannya. Puslitbangtan. Bogor. 66 p.
- [8] Berlinger, M. J. 1986. Host Plant Resistance to *Bemisia tabaci*. *Agriculture, Ecosystems & Environment* 17(1–2): 69–82.
- [9] Marwoto, F.C. Indriani, A. Sulistyono, dan R.T. Hapsari. 2011. Diagnosis Ledakan Populasi Hama Kutu Kebul *Bemisia tabaci* pada Pertanaman Kedelai (Studi Kasus Faktor Penyebab Ledakan Populasi Kutu Kebul di KP Muneng MK 2009). Hlm. 277–288. Dalam A. Setyorini dan Marwoto: *Kutu Kebul, Sistem Pengairan, dan Budidaya Kedelai* 262.
- [10] Sulistyono Dwi Setyorini dan Marwoto. 2017. Perkembangan Populasi dan Serangan Kutu Kebul pada Kedelai dengan Sistem Pengairan dan Teknik Budidaya Berbeda. *Prosiding. Balai Penelitian Tanaman Aneka Kacang dan Umbi*. Malang. https://balitkabi.litbang.pertanian.go.id/wp-content/uploads/2017/07/pros16_31.pdf.
- [11] Widjono, Hermanto, M. Muchlish Adie, Y. Prayogo, Suharsono, Sholikin, A.A, Rahmianna, N. Nugrahaeni, N. Saleh, A. Kasno, Subandi, dan Marwoto (peny.). *Prosiding Seminar Nasional Hasil Penelitian Tanaman Kacang-kacangan dan Umbi-umbian* Tanggal 21 Desember 2009.
- [12] Erdiansyah, I., Eliyatningsih, E., Sari, V. K., & Nurahmanto, D. (2021, March). Utilization of javanese ginseng and citronella for insect diversity in Pace village, Jember regency. In *IOP*

Conference Series: Earth and Environmental Science (Vol. 672, No. 1, p. 012096). IOP Publishing.

- [13] Erdiansyah, I., Damanhuri, F. N. U., & Azizah, P. Z. (2019). Isolasi dan Identifikasi Cendawan Mikoriza Arbuskular Pada Tiga Pusat Lokasi Tanaman Jagung di Kabupaten Jember. *Agriprima: Journal of Applied Agricultural Sciences*, 3(2), 41-50.

Intercropping patterns effect of cardamom and cayenne pepper on population and intensity of whitefly pest's attacks (Bemisia tabaci)

ORIGINALITY REPORT

8%

SIMILARITY INDEX

6%

INTERNET SOURCES

10%

PUBLICATIONS

7%

STUDENT PAPERS

PRIMARY SOURCES

1

Submitted to Universitas Jenderal Soedirman

Student Paper

4%

2

repository.untad.ac.id

Internet Source

2%

3

I Erdiansyah, R Taufika, TW Widodo, Damanhuri, dan DM Jannah, H Prayitno. "Viability of biofertilizer bacteria Rhizobium spp based on household waste", IOP Conference Series: Earth and Environmental Science, 2022

Publication

2%

Exclude quotes On

Exclude matches < 2%

Exclude bibliography On